

UNITED STATES DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

TECHNICAL GUIDE
SECTION IV

STATEWIDE

Irrigation Water Conveyance 430-HH-1

Irrigation Water Conveyance (Ft)

Rigid Gated Pipeline

Definition

A rigid pipeline, with closely spaced gates, installed as part of a surface irrigation system.

Scope

This standard applies to the design and installation of rigid gated pipe. It includes material specifications for aluminum and polyvinyl chloride (PVC) plastic gated pipe.

Purpose

To efficiently convey and distribute water to the land surface for better water management, without causing excessive erosion, water losses, or reduction in water quality.

Conditions where practice applies

The rigid gated pipeline shall be planned and located to serve as an integral part of an irrigation distribution system that has been designed to help conserve soil and water resources on a farm. This practice shall not be used in lieu of buried pipelines for conveyance systems; however, reaches of ungated pipe may be used to obtain necessary working pressure for the system or to convey the water to various points in the field.

Water supplies and rates of irrigation delivery for the area served by the gated pipe shall be sufficient to make irrigation practical for the crop to be grown and for border, furrow, corrugation, or contour water application methods.

Design criteria

Working pressure. The maximum working pressure shall be 10 psi or 23 ft of head. Design working heads in excess of 23 feet shall be controlled by installing orifice plate head reducers, butterfly valves, stand pipes, or other appurtenances for head control.

Friction losses. For design purposes, friction head losses shall be no less than those computed by the Hazen-Williams equation, using a roughness coefficient of $C=130$ for aluminum pipe and $C=150$ for plastic pipe. A multiple outlet factor shall be used in computing losses only when it affects the design pipe size.

Flow velocity. The design velocity in the pipeline when operating at system capacity shall not exceed 7 ft/s.

Capacity. The design capacity of the pipeline shall be sufficient to deliver an adequate irrigation stream to the design area for the planned irrigation method.

Outlet gates. Individual outlet gates shall have the capacity at design working pressure to deliver the required flow to a point at least 0.3 ft above the field surface.

Head requirement. The working head shall not be less than 0.5 ft above outlet gates, unless a detailed design is completed to indicate that a lower head requirement is adequate. Where streamflows are erosive, a "sock" shall be installed on each gate or some other means of erosion control shall be provided.

Flushing. A suitable outlet shall be installed at the terminal end of the pipeline if needed for flushing the line free of sediment or other foreign material.

Quality of water. Water quality shall be evaluated for all aluminum pipeline installations. A copper content in excess of 0.02 ppm produces nodular pitting and rapid deterioration of pipe if water is allowed to become stagnant. The pipeline should be drained after use. Provisions shall be made to prevent trash inflow into the gated pipeline.

Materials. Pipe materials shall equal or exceed the physical requirements specified under "Materials."

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Related structures

Onfarm irrigation delivery systems shall meet or have a plan for improving the system to meet the appropriate irrigation water conveyance standard.

Appurtenances used to join the gated pipeline to the delivery system outlet must have adequate capacity at design working head to deliver the required flow.

Plans and specifications

Plans and specifications for installing gated pipelines shall be in keeping with this standard and shall describe the requirements for applying the practice to achieve its intended purposes.

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Rigid Gated Pipeline Specifications

Installation

The pipe shall be installed according to the recommendations of the manufacturer.

Joints and connections. All joints and connections shall be capable of withstanding the design maximum working head for the pipeline without leakage and shall leave the inside of the line free of any obstruction that can reduce the capacity below design requirements. All fittings shall be installed according to the recommendations of the manufacturer.

If dissimilar metals are used, the fittings or orifice plates shall be protected against galvanic corrosion. For example, separate dissimilar metals with a rubber or plastic insulator.

A flexible connection shall be installed between the pump discharge pipe and the pipeline. Aluminum lines shall be coupled with a suitable insulating material.

Basis of acceptance. The acceptability of the pipe shall be determined by inspection to check compliance with all the provisions of this standard with respect to the design of the line, the pipe and pipe markings, the appurtenances used, and the minimum installation requirements.

Certification. If requested by the state conservation engineer, the manufacturer shall certify that the pipe complies with the requirements of this standard.

Materials

Gated pipe shall be aluminum, plastic, or other materials approved in accordance with Part 512, Subpart C of the National Engineering Manual.

Aluminum pipe

Chemical composition. The pipe shall conform to the chemical composition criteria in ASTM-B-241, Specifications for Aluminum-Alloy Seamless Pipe and Seamless Extruded Tube; ASTM-B-313, Specifications for Aluminum-Alloy Round Welded Tubes; and ASTM-B-210, Specifications for Aluminum-Alloy Drawn Seamless Tubes.

Wall thickness. The pipe shall meet the minimum wall thickness listed in table 1 for the given pipe diameter and specified material.

Plastic pipe

Quality of plastic. Compounds used in manufacturing plastic gated irrigation pipe shall meet the requirements of one of the PVC materials as specified in ASTM-D-1784 and shown in table 2.

The compound shall contain an ultra-violet stabilizer that will protect against solar degradation for a minimum of 5 years.

Clean, rework material generated from the manufacturer's own pipe production may be used by the same manufacturer if the pipe produced meets all requirements of this standard.

The pipe shall be homogeneous throughout and free from visible cracks, holes, foreign matter, or other defects. The pipe shall be as uniform in color, opacity, density, and other physical properties as is commercially practicable.

Table 1.—Minimum wall thickness for aluminum gated pipe

Tube diameter	Minimum wall thickness
<i>in</i>	<i>in</i>
6	.050
8	.050
10	.050
12	.058

Table 2.—Material specifications for plastic gated pipe

Code classification	Designation
12454-B	PVC 1120
12454-C	PVC 1220
13333-D	PVC 2116
13333-D	PVC 2112
13333-D	PVC 2110

Table 3.—Dimensions and tolerances of rigid gated plastic pipe.

Nominal size	Outside diameter		Wall thickness	
	Average	Tolerance	Minimum	Tolerance
<i>in</i>	<i>in</i>	<i>in</i>	<i>in</i>	<i>in</i>
6	6.000	± 0.011	0.120	± 0.020
8	8.000	± .015	.120	± .020
10	10.000	± .015	.120	± .020
12	12.000	± .015	.120	± .020

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Pipe requirements. The rigid plastic gated pipe shall meet the dimensional requirements listed in table 3. The minimum working pressure class for this pipe without gates shall be 22 psi or 50 ft of head.

In addition, the pipe shall meet the requirements of ASTM-D-2241, Polyvinyl Chloride (PVC) Plastic Pipe (SDR-PR), as shown in sections pertaining to dimensions and tolerances, flattening, extrusion, quality, conditioning, test conditions, and sampling. The dimensions and tolerances in table 3 shall apply.

Pipe markings for plastic pipe

Markings. Markings on the pipe shall include the following, spaced at intervals of not more than 5 ft.

1. Nominal pipe size (for example, 10 in).
2. Applicable material specification according to the designation code (for example, PVC 1120).
3. Manufacturer's name or trademark.

Fittings and couplers. All fittings and couplers shall equal or exceed the pressure rating of the pipe with which they are used. They shall be made of material that is recommended by the manufacturer for use with the pipe.

The pipe and appurtenances shall be furnished with a coupling system that is interchangeable with aluminum gated pipe.

Rubber gaskets. Gasket dimensions shall be according to the manufacturer's standard design dimensions and tolerances. The gasket shall be of such size and shape as to provide an adequate compressive force against the spigot and socket after assembly to effect a positive seal.

The gasket shall be the sole element depended upon to make the joint flexible and watertight. The gasket shall be a continuous elastomeric ring.

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Irrigation Water Conveyance Rigid Gated Pipeline (ft)

Planning considerations for water quantity and quality

Quantity

1. Effects on the water budget, especially on volumes and rates of infiltration, evaporation, transpiration, deep percolation, and ground water recharge.
2. Effects on downstream flows or aquifers that would affect other water uses or users.
3. Potential use for irrigation water management.

Quality

1. Effects on erosion along furrows and the movement of sediment and soluble and sediment-attached substances carried from the field.
2. Effects on the movement of dissolved substances into the soil, and on percolation below the root zone or to ground water recharge.
3. Potential effect of water level control on soil nutrient processes such as plant nitrogen use or denitrification.
4. Effects on the salinity of soils, soil water, or downstream flows.
5. Effects of controlled water delivery on water temperatures that could cause undesirable effects on aquatic and wildlife communities.
6. Effects on the visual quality of water resources.

MONTANA SUPPLEMENT

Irrigation Water Conveyance (430-HH)

Rigid Gated Pipeline

The following additional standards apply to rigid gated pipelines.

Established minimum life. 10 years

Design Criteria

Materials. All materials described and required in this standard shall meet or exceed the minimum requirements stated in Montana Construction and Construction Material Specification MT-430-HH.

Plans and specifications. The plans must specify the diameter, wall thickness, applicable material type and material specification of the rigid gated pipe required for the installation.

Montana Construction and Construction Materials Specification MT-430-HH applies to this practice.

Plans and specifications are to be developed for each installation, and approved by the individual having design approval authority for the project.

If other additional specifications or measurement and payment clauses are required, they shall be in keeping with the requirements of Construction and Material Specifications, NEH Section 20. (Consult area engineer).